

## **An Evaluation of Bone Marrow Aspirate Concentrate in Osteointegration of Fresh Osteochondral Allografts**

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**Purpose:** Bone healing is essential for success with fresh osteochondral allograft (OCA) transplants. Success rates are good (71% to 85% 10-year survival), but failure occurs from chondrocyte death or failure of bone integration. This project evaluates enhanced OCA bone healing using bone marrow aspirate concentrate (BMC). BMC contains osteoprogenitor cells and osteoinductive proteins that may accelerate OCA integration. The *in vitro* study compares saline control with platelet-rich plasma (PRP) and BMC in explants. The *in vivo* study compares radiographic integration of large femoral condyle OCAs with or without BMC. Our hypothesis is that BMC will enhance OCA bone healing.

**Methods:** With IACUC (Institutional Animal Care and Use Committee) approval, BMC and PRP were processed from dogs using commercially available systems. OCAs (n = 36) were obtained from femoral condyles immediately after euthanasia. On day 21 of preservation, grafts were either lavaged with saline or soaked either in PRP or BMC. OCAs were cultured for 7 or 14 days and evaluated for cell osteoprogenitor colonization and osteoinductive proteins. With IRB approval, patients' postoperative radiographs were assessed for graft incorporation and degree of sclerosis 6 weeks, 3 months, and 6 months following OCA transplantation with (n = 23) or without BMC (n = 16). Integration was evaluated by an independent musculoskeletal radiologist blinded to treatment.

**Results:** All BMC OCAs had viable osteoprogenitor cells distributed throughout the bone at 7 and 14 days. Viable cells were not observed in OCA bone of PRP or control OCAs at either time point. Osteoinductive proteins were eluted from PRP and BMC OCAs, with BMC having higher levels. In the clinical study, BMC OCAs had significantly (P <0.03) higher graft integration at 6 weeks, 3 months, and 6 months after surgery. Graft sclerosis was significantly (P <0.017) less in the BMC group at 6 weeks and 3 months post surgery.

**Conclusion:** OCAs treated with BMC had significantly more osteoprogenitor cells and osteoinductive proteins when compared to PRP or saline controls. Treatment of large OCAs with BMC led to more rapid osseous integration at all time points and less sclerosis during early healing compared with controls. BMC appears to have significant beneficial effects on osseous integration of OCAs via osteoprogenitor cells and osteoinductive proteins.